

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (currently amended): A transport layer relay method performed by a transport layer relay device, the method comprising:

terminating, at the transport layer relay device, a first transport layer connection between a first source terminal and a first destination terminal at a first transmission rate in the transport layer and a second transport layer connection between a second source terminal and a second destination terminal at a second transmission rate in the transport layer;

relaying data flow of said first transport layer connection to said first destination terminal as a first relay connection and data flow of said second transport layer connection to said second destination terminal as a second relay connection to respectively separate said first and second transport layer connections;

determining a total transmission rate of said first and second relay connections based on the first and second transmission rates;

determining a first reallocated transmission rate and a second reallocated transmission rate, the first reallocated transmission rate and the second reallocated transmission rate apportioned from the total transmission rate; and

allocating the total transmission rate among the determined first reallocated transmission rate to each of said first relay connection and the determined second reallocated transmission rate to said second relay connection-connections,

wherein the first source terminal, the second source terminal, the first destination terminal, and the second destination terminal are different from each other.

2. (previously presented): The method according to claim 1, wherein said total transmission rate is determined in accordance with the number of transport layer connections that are being relayed and congestion conditions of a network through which the relay connections pass.

3. (previously presented): The method according to claim 1, wherein said total transmission rate is determined in accordance with the number of transport layer connections that are being relayed and congestion conditions of a network through which the relay connections pass such that desired effective transmission rates are attained for each relay connection.

4. (previously presented): The method according to claim 1, wherein said total transmission rate is determined in accordance with the number of transport layer connections that are being relayed and congestion conditions of a network through which the relay connections pass such that effective transmission rates are attained for each relay connection , and

wherein transmission rates for traffic, other than the relay connections, that shares a bottleneck with the relay connections are allocated differently than transmission rates allocated to the relay connections.

5. (previously presented): The method according to claim 1, wherein said total transmission rate is allocated to transmission rates of each of said first and second relay

connections depending on application information in said data flow of each of said first and second relay connections.

6. (previously presented): The method according to claim 1, further comprising estimating, by means of measurement packets, congestion conditions of a network through which the first and second relay connections pass,
wherein said congestion conditions are used to determine said total transmission rate.

7. (previously presented): The method according to claim 1, further comprising estimating, by means of relay packets, congestion conditions of a network through which the first and second relay connections pass,
wherein said congestion conditions are used to determine said total transmission rate.

8. (currently amended): A transport layer relay device comprising:
a first terminal-side connection termination unit that terminates a first transport layer connection between a first source terminal and a first destination terminal in a transport layer;
a second terminal-side connection termination unit that terminates a second transport layer connection between a second source terminal and a second destination terminal in a transport layer;
a first interdevice connection termination unit that terminates a first transport layer connection with a first transport layer relay device that relays transport layer data between said first terminal-side connection termination unit and said first interdevice connection termination unit;

a second interdevice connection termination unit that terminates a second transport layer connection between a second transport layer device that relays transport layer data between said second terminal-side connection termination unit and said second interdevice connection termination unit; and

a transmission rate control unit that controls transmission rates of said first and second interdevice connection termination units,

wherein the transmission rate control unit determines a total transmission rate of all interdevice connection termination units, ~~allocates~~ determines a first reallocated transmission rate and a second reallocated transmission rate, the first reallocated transmission rate and the second reallocated transmission rate apportioned from said total transmission rate, allocates among the determined first reallocated transmission rate to said first interdevice connection termination unit and the determined second reallocated transmission rate to said second interdevice connection termination ~~units~~ unit, and reports a transmission rate that has been allocated to said first and second interdevice connection termination units, said first interdevice connection termination unit relaying said first transport layer connection to said first destination terminal as a first relay connection based on said first reallocated ~~allocated total~~ transmission rate and said second interdevice connection termination unit relaying said second transport layer connection to said second destination terminal as a second relay connection based on said second reallocated ~~allocated total~~ transmission rate, and

wherein the first source terminal, the second source terminal, the first destination terminal, and the second destination terminal are different from each other.

9. (previously presented): The device according to claim 8, wherein said transmission rate control unit determines said total transmission rate in accordance with the number of transport layer connections that are being relayed and connection-specific congestion information reported from each interdevice connection termination unit.

10. (previously presented): The device according to claim 8, wherein said transmission rate control unit determines said total transmission rate in accordance with the number of transport layer connections that are being relayed and connection-specific congestion information reported from each interdevice connection termination unit such that effective transmission rates for each relay connection attain a desired transmission rate.

11. (previously presented): The device according to claim 8, wherein said transmission rate control unit determines said total transmission rate in accordance with the number of transport layer connections that are being relayed and connection-specific congestion information reported from each interdevice connection termination unit such that effective transmission rates for each relay connection are attained, and

wherein transmission rates for traffic, other than the relay connections, that shares a bottleneck with the relay connections are allocated differently than transmission rates allocated to the relay connections.

12. (previously presented): The device according to claim 8, further comprising:

an application information analysis unit that, when relaying transport layer data between each of said first and second terminal-side connection termination units and each of said first and second interdevice connection termination units, analyzes application information in said transport layer data,

wherein said transmission rate control unit allocates said total transmission rate among the transmission rates of each of said first and second relay connections based on the application information analyzed by said application information analysis unit.

13. (previously presented): The device according to claim 8, further comprising:
a network condition estimation unit that, based on measurement packets, estimates congestion conditions of a network through which said first and second relay connections pass,
wherein said transmission rate control unit uses the congestion conditions estimated by said network condition estimation unit to determine said total transmission rate.

14. (previously presented): The device according to claim 8, further comprising:
an inline measurement unit that, by means of packets that are relayed, estimates congestion conditions of a network through which said first and second relay connections pass,
wherein said transmission rate control unit uses the results estimated by said inline measurement unit to determine said total transmission rate.

15. (currently amended): A transport layer relay method performed by a transport layer relay device, the method comprising:

terminating, at the transport relay device, each of a plurality of transport layer connections in a first transport layer and each of a plurality of transport layer connections in a second transport layer;

grouping the plurality of connections in the first transport layer into a first relay connection in the first transport layer and the plurality of connections in the second transport layer into a second relay connection in the second transport layer;

determining a total transmission rate of the first and second relay connections;

determining a first reallocated transmission rate and a second reallocated transmission rate, the first reallocated transmission rate and the second reallocated transmission rate apportioned from the total transmission rate;

allocating the total transmission rate among the determined first reallocated transmission rate to each of said first relay connection and the determined second reallocated transmission rate to said second relay connectionsconnection,

wherein the plurality of connections in said first transport layer are grouped as the first relay connection in accordance with a the first reallocated transmission rate allocated from the total transmission rate and the plurality of connections in the second transport layer are grouped as the second relay connection in accordance with a the second reallocated transmission rate allocated from the total transmission rate.

16. (previously presented): The method according to claim 15, wherein said total transmission rate is determined in accordance with the number of transport layer connections that

are being relayed and congestion conditions of a network through which the relay connections pass.

17. (previously presented): The method according to claim 15, wherein said total transmission rate is determined in accordance with the number of transport layer connections that are being relayed and congestion conditions of a network through which the relay connections pass such that desired effective transmission rates are attained for each relay connection.

18. (previously presented): The method according to claim 15, wherein said total transmission rate is determined in accordance with the number of transport layer connections that are being relayed and congestion conditions of a network through which the relay connections pass such that effective transmission rates are attained for each relay connection, and

wherein transmission rates for traffic, other than the relay connections, that shares a bottleneck with the relay connections are allocated differently than transmission rates allocated to the relay connections.

19. (previously presented): The method according to claim 15, wherein data flows from each of said plurality of connections in the first transport layer and the plurality of connections in the second transport layer are grouped in accordance with transmission rates for which said total transmission rate has been allocated based on application information in said plurality of connections in the first transport layer and the plurality of connections in the second transport layer.

20. (previously presented): The method according to claim 15 further comprising estimating, by means of measurement packets, congestion conditions of network through which the first and second relay connections pass,

wherein said congestion conditions are used to determine said total transmission rate.

21. (previously presented): The method according to claim 15 further comprising estimating, by means of relay packets, congestion conditions of a network through which the first and second relay connections pass,

wherein said congestion conditions are used to determine said total transmission rate.

22. (currently amended): A transport layer relay device comprising:
a plurality of terminal-side connection termination units that terminate transport layer connections between a plurality of source terminals and a plurality of destination terminals in the transport layer;

an interdevice connection termination unit that terminates a plurality of transport layer connections with a plurality of transport layer relay devices that relay transport layer data between said plurality of terminal-side connection termination units and said interdevice connection termination unit; and

an MUX-DEMUX unit that groups transport layer data from each of said plurality of terminal-side connection termination units as a plurality of relay connections and transfers the plurality of relay connections to said interdevice connection termination unit; and

a transmission rate control unit that determines a total transmission rate of the plurality of relay connections, determines reallocated transmission rates apportioned from the total transmission rate, and allocates ~~each the reallocated transmission rate of the plurality of relay connections based on the total transmission rate~~ reallocated transmission rates to the plurality of relay connections,

wherein said interdevice connection termination unit transmits said plurality of relay connections to said plurality of destination terminals in accordance with the ~~total transmission rate~~ reallocated transmission rates,

wherein said MUX-DEMUX unit groups data from the plurality of terminal-side connection termination units in accordance with the reallocated transmission rates allocated by the transmission rate control unit, and

wherein the transmission rate control unit determines the ~~total transmission rate~~ reallocated transmission rates of said interdevice connection termination unit and reports the allocation of the reallocated transmission rates among the plurality of relay connections to said MUX-DEMUX unit.

23. (previously presented): The device according to claim 22, wherein said transmission rate control unit determines said total transmission rate in accordance with the number of transport layer connections that are being relayed and congestion information of connections reported from the interdevice connection termination unit.

24. (previously presented): The device according to claim 22, wherein said transmission rate control unit determines said total transmission rate in accordance with the number of transport layer connections that are being relayed and congestion information of connections reported from the interdevice connection termination unit such that effective transmission rates for each of the plurality of relay connections attain a desired rate.

25. (previously presented): The device according to claim 22, wherein said transmission rate control unit determines said total transmission rate in accordance with the number of transport layer connections that are being relayed and congestion information of connections that from each interdevice connection termination unit such that effective rates for each of the plurality of relay connections are attained , and

wherein transmission rates for traffic, other than relay connections, that share a bottleneck with the plurality of relay connections are allocated differently than transmission rates allocated to the relay connections.

26. (previously presented): The device according to claim 22, further comprising:
an application information analysis unit that analyzes application information in transport layer data when transport layer data are transferred between each of said terminal-side connection termination units and said MUX-DEMUX unit[[]],

wherein said transmission rate control unit allocates said total transmission rate among the transmission rates of each of the plurality of relay connections and reports the allocated

transmission rates to said MUX-DEMUX unit based on the application information analyzed by said application information analysis unit.

27. (previously presented): The device according to claim 22, further comprising:
a network condition estimation unit that, by means of measurement packets, estimates congestion conditions of a network through which plurality of relay connections pass[[]],
wherein said transmission rate control unit uses congestion conditions estimated by said network condition estimation unit to determine said total transmission rate.

28. (previously presented): The device according to claim 22, further comprising:
an inline measurement unit that, by means of packets that are relayed, estimates congestion conditions of a network through which the plurality of relay connections pass[[]],
wherein said transmission rate control unit uses the congestion conditions estimated by said inline measurement unit to determine said total transmission rate.

29. (previously presented): The method according to claim 1, wherein, when establishing a new transport layer connection between a new source terminal and a new destination terminal, said total transmission rate is determined, said total transmission rate is allocated to each relay connection, and the allotted transmission rates are reported to a partner transport layer relay device in establishing said new transport layer connection.

30. (previously presented): The device according to claim 8, wherein, when establishing a transport layer connection between a new source terminal and a new destination terminal, an initial transmission rate is reported to the destination from said transmission rate control unit.

31. (previously presented): The method according to claim 15, wherein, when establishing new transport layer connection between a new source terminal and a new destination terminal, said total transmission rate is allocated and the allocated transmission rates are reported to a partner transport layer relay device in establishing said new transport layer connection.

32. (previously presented): The device according to claim 22, wherein, when establishing a transport layer connection between a new source terminal and a new destination terminal, an initial transmission rate that is reported from said transmission rate control unit is reported to the new destination terminal.

33. (currently amended): A program embodied on a tangible computer-readable medium, which when executed by a computer, causes the computer to function as a transport layer relay device comprising:

a first terminal-side connection termination unit that terminates a first transport layer connection between a first source terminal and a first destination terminal in a first transport layer;

a second terminal-side connection termination unit that terminates a second transport layer connection between a second source terminal and a second destination terminal in a transport layer;

a first interdevice connection termination unit that terminates a first transport layer connection with a first transport layer relay device that relays transport layer data between said first terminal-side connection termination unit and said first interdevice connection termination unit;

a second interdevice connection termination unit that terminates a second transport layer connection between a second transport layer device that relays transport layer data between said second terminal-side connection termination unit and said second interdevice connection termination unit; and

a transmission rate control unit that controls transmission rates of said first and second interdevice connection termination units,

wherein the transmission rate control unit determines a total transmission rate of all interdevice connection termination units, ~~allocates~~ determines a first reallocated transmission rate and a second reallocated transmission rate, the first reallocated transmission rate and the second reallocated transmission rate apportioned from said total transmission rate, allocates among the determined first reallocated transmission rate to said first interdevice connection unit and the determined second reallocated transmission rate to said second interdevice connection termination unit, and reports a transmission rate that has been allocated to said first and

second interdevice connection termination units, said first interdevice connection termination unit relaying said first transport layer connection to said first destination terminal as a first relay connection based on said first reallocated ~~allocated total~~-transmission rate and said second interdevice connection termination unit relaying said second transport layer connection to said second destination terminal as a second relay connection based on said second reallocated ~~allocated total~~-transmission rate, and

wherein the first source terminal, the second source terminal, the first destination terminal, and the second destination terminal are different from each other.

34. (currently amended): A program embodied on a tangible computer-readable medium, which when executed by a computer, causes the computer to function as a transport layer relay device comprising:

a plurality of terminal-side connection termination units that terminate transport layer connections between a plurality of source terminals and a plurality of destination terminals in the transport layer;

an interdevice connection termination unit that terminates a plurality of transport layer connections with a plurality of transport layer relay devices that relay transport layer data between said plurality of terminal-side connection termination units and said interdevice connection termination unit;

a MUX-DEMUX unit that groups transport layer data from each of said plurality of terminal-side connection termination units as a plurality of relay connections and transfers the plurality of relay connections to said interdevice connection termination unit; and

a transmission rate control unit that determines a total transmission rate of the plurality of relay connections, determines reallocated transmission rates apportioned from the total transmission rate, and allocates ~~each the reallocated transmission rate of the plurality of relay connections based on the total transmission rate~~ reallocated transmission rates to the plurality of relay connections,

wherein said interdevice connection termination unit transmits said plurality of relay connections to said plurality of destination terminals in accordance with the ~~total transmission rate~~ reallocated transmission rates,

wherein said MUX-DEMUX unit groups data from the plurality of terminal-side connection termination units in accordance with the reallocated transmission rates allocated by the transmission rate control unit, and

wherein the transmission rate control unit determines the ~~total transmission rate~~ reallocated transmission rates of said interdevice connection termination unit and reports the allocation of the reallocated transmission rates among the plurality of relay connections to said MUX-DEMUX unit.